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AND ASSOCIATES INC.

**DATE:** July 30, 2007  
**TO:** Bob Hutchinson  
**FROM:** Jon Harper  
**SUBJECT:** Task 3.0 - Slab Design Review  
**PROJECT:** Courthouse Square - Slab Evaluation  
**PROJECT NO:** MARN0000-0036  
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This memo is intended to provide a brief summary of work completed to date regarding the Courthouse Square Slab Evaluation project. DEA has completed tasks 1.0 (Floor Elevation Survey), 2.0 (Construction Document Review) and 3.0 (Slab Design Review) specific to the fifth floor which appeared to have the most cosmetic damage. Our preliminary conclusions are as follows:

Task 1.0 : Measure spot elevations at 15 individual locations at the fifth floor focused in an area at the northeast side of the building. (Directly north of the east stairwell.) **Survey information previously provided in full in a separate deliverable. Partial survey information provided below.**

Task 2.0 : Review general contractors' documents relative to slab formwork methods including shoring and re-shoring removal. Review special inspection reports relative to slab construction. This includes slab reinforcement inspection and testing of concrete strength for the concrete slabs. Review rebar shop drawings and steel tendon drawings and calculations. Review contractor requests for information (RFI's) relative to the slab construction. **Reviewed construction documents provided by Marion County and Arbuckle Costic Architects.**

Task 3.1 : Review as-built structural drawings to determine slab reinforcement information. Compare with rebar and steel tendon shop drawings. **In general, as-built structural drawings match rebar and steel tendon shop drawings. See itemized comments below for specific irregularities or concerns.**

Task 3.2 : Analyze the existing slab design at the fifth floor level to verify structural adequacy to support required vertical loads. **DEA analyzed five individual slab segments located at the fifth floor level (see attached calculations). All five conditions were modeled based on the rebar and steel tendon shop drawings. Slab appears adequate at all locations to support the required vertical loads.**

Task 3.3 : Calculate slab deflection due to dead and live load and compare with the as-built measurements. See table below for surveyed deflections versus calculated deflections.

	in.	in.	in.
Location	Surveyed Deflection (DL+LL)	Calculated Deflection (DL+LL)	$\Delta_{\text{surveyed vs calculated}}$
K/10.5	1.86	1.10	0.76
L/10.5	3.42	1.14	2.28
M/10.5	3.12	1.77	1.35

In addition to task summaries listed above, the following items/issues were discovered during this task and should be noted:

- There appears to be a discrepancy between the number of tendons indicated on the fifth floor pt shop drawings and the fifth floor elongation (inspection) reports relative to slab segments at Grids G & H. The slab at these locations was checked for the tendon configuration depicted in the elongation reports and appears adequate, but this raises the question as to whether there might have been confusion in the field regarding the layout of the banded tendons possibly leading to improper placement.
- In a structural observation report dated February 24, 2000, Tim Terich (with Century West Engineering) states: "Observed the floor grinding of slabs in the west stairs, where the concrete was poured too high. Grinding has exposed 2-3 tendons running parallel to the door opening. The tendons lie within 1"-2" of the top of the slab. These tendons are not significant to the integrity of the slab. The tendons Mr. Terich refers to are distributed tendons running in the east-west direction. The removal of these tendons would not be expected to impact the slabs structural integrity. However, this does raise the question as to whether other, more important, tendons were cut in the field in a similar fashion without documentation.
- RFI 22 states "Are there more pt cables required between 10 & 10a, K-O?" Structural engineer answered "Yes. See shops for adjustment.". DEA was unable to locate pt shop drawings showing a modification.
- DEA located a fax transmittal dated July 22, 1999 from Tim Terich which states: "Attached is a re-design of reinforcing near the west shear wall to account for the removal of 'short' tendons." The sketch referenced in this transmittal was not located.
- There was a mark-up by Mr. Terich on the third floor rebar shop drawings calling for a tighter rebar spacing than what was originally detailed (denoted by hand written comments by Mr. Terich on the shop drawing). Mr. Terich included a note on the fourth and fifth floor rebar shop drawings directing the contractor to reference the third floor rebar shop drawing for information. It is possible this additional reinforcement was not added in the field if the contractor was building off of the shop drawings and did not catch the 'reference' note on the fourth and fifth floor drawings.

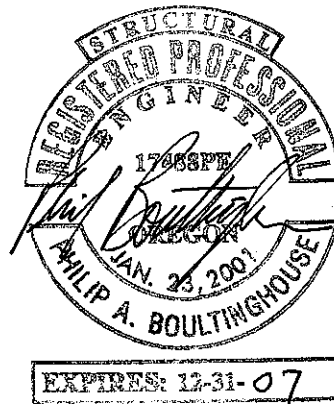
Bob Hutchinson

July 30, 2007

Page 3

- In a letter dated May 5, 1999, Leonard Lodder (with Arbuckle Costic Architects) writes to Glen Cook (with Century West Engineering) saying: "I have recently succeeded in reviewing with the Owner's project manager your request for additional fees to cover perceived changes in scope for the project during the design development and construction document phases of the project. Unfortunately, our review is tempered by the significant number of RFIs from the Contractor regarding structural issues. There is considerable concern that the level of completeness of the structural drawings will expose the Owners to significant additional costs through change orders." If this is the case and there was a large number of RFIs on the project, the possibility of errors and/or omissions in the construction phase would have increased.
- Per the Permit Set drawings, the only top mat reinforcement called out in the fifth floor slab is #4 @ 24" o.c. at the pour strip and (8) #6 each way at the columns. Additional welded wire fabric appears to have been added in the field (handwritten note has been added to the as-built drawings), however, DEA was unable to find rebar shop drawings detailing this additional reinforcement. Based on the slab analysis outlined above, this appears to be a less than adequate amount of top mat reinforcement.

This memo was prepared to provide a brief summary of information reviewed to date. So far it is clear that the floor slabs at the third, fourth and fifth floor have deflected more than expected. Any conclusions regarding the cause of this deflection or the structural adequacy of the slabs cannot be made until further evaluation has been performed. Therefore, we request authorization to proceed with task 4.0 to verify the existing slab construction.



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